ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

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Requirements for Geothermal Systems in New Hampshire

What are geothermal heating and cooling systems?

A geothermal heating and cooling system, also called geo-exchange or ground-source heat pump system, is one that uses heat stored in the ground to heat or cool a home or building. These systems work by circulating a fluid through a well or a trench in the ground and "capturing" the heat of the shallow earth. The fluid then transfers the heat into a structure where it is distributed by an air blower or through hot water piping. In the summer, these systems can commonly be operated in reverse, capturing the heat from the structure and subsequently transferring it to the earth, thereby cooling the structure during hotter weather.

Geothermal systems present the consumer with a unique set of benefits that are not commonly associated with most current heating and cooling systems. Although the initial costs for these systems may be greater than a conventional heating and cooling system, over time they generally provide a savings in cost to homeowners and businesses, because they consume less energy to operate and are not directly tied to fuel prices. Their greatest advantage, however, is the fact that by concentrating heat that is naturally present in the shallow earth, rather than producing heat through the combustion of fossil fuels, they greatly reduce greenhouse gas and other air emissions, which significantly impact the environment.

Types of Geothermal Systems

There are essentially two types of geothermal systems used in New Hampshire. The most common type is referred to as an "open-loop" geothermal system, and includes a groundwater well (or wells), a water well pump, piping and a compressor [heat pump] installed in the structure. In this type of system, groundwater is used as the heat transfer fluid and is pumped out of the well, and circulated through the structure's heat pump where heat is extracted from or injected into the water. Then the heated/cooled water is re-injected into the same groundwater well from which it was withdrawn or a separate well dedicated to re-injection.

The less frequent type used in the state is a "closed-loop" geothermal system. In these systems, an antifreeze solution or refrigerant is circulated through a continuous loop of plastic or copper pipe, which is installed in either a drilled well, horizontal trench or the bottom of a surface water body. Similar to the above, heat is either injected into or extracted from the antifreeze/refrigerant by the heat pump; after which, the fluid is re-circulated back into the loop of pipe installed in the ground.

A third type of system, commonly referred to as a "hydrothermal" system, uses very deep wells drilled into hot, dry rock formations to generate steam for electricity generation or a large-scale heat source. Entities developing this type of system should contact DES before initiating the project.

State Registration Requirements
Under federal law, EPA has established several classes of injection wells and requires state's to inventory these wells. Open-loop geothermal wells as described above are designated as Class V injection wells, which are required to register with the New Hampshire's Underground Injection Control (UIC) program in accordance with Administrative Rule Env-Wq 402 *Groundwater Discharge Permit and Registration*. Closed-loop geothermal systems, although they do not commonly incorporate Class V injection wells, are included in the UIC registration process to ensure that these systems comply with Env-Wq 401*Best Management Practices for Groundwater Protection*.

The UIC registration process for geothermal systems is divided into two general groups based on type of use, as follows:

1. **Geothermal System Registration for Single-Unit Residences**: This one-page registration form is for a geothermal system installed at a single residential home; see http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge/documents/template_geothermal_residential.pdf. The form can be filled out by the home owner, driller or designer and requests information on the system's type, location and whether or not it also provides drinking water. DES uses the information for inventory purposes and will follow-up with the owner by providing recommended guidelines on private well sampling and disinfection procedures.

2. **Geothermal System Registration for Industrial, Commercial and Institutional (ICI) Facilities**: This registration form is for a geothermal system installed at any ICI facility; see http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge/documents/template_geothermal_ind.pdf. Generally, this form is completed by the geothermal system designer/installer and requires submission of a facility site plan showing the location of the withdrawal and injection wells, system flow meters and sampling points, as well as an operational water balance that estimates volumes of withdrawn, injected and rejected water. The additional information is required to assist the UIC program coordinator in determining if other DES permitting programs apply to the project and greatly simplifies the process for a registrant by providing a single form and point of contact. The registration issued for these systems will include conditions relative to the various DES programs involved, as necessary.

Well Construction Requirements
Wells and boreholes drilled for use with both open- and closed-loop geothermal systems are required to meet certain siting and construction standards established by the New Hampshire Water Well Board, see http://des.nh.gov/organization/divisions/water/dwgb/wwb/index.htm for details.

For additional information on geothermal system registration requirements, contact the UIC program coordinator at (603) 271-2858 or mitchell.locker@des.nh.gov.